



PROCEDURE

Heat Stress

Procedure	2.32.2.1.18.01
Established	01.06.2016
Effective Date	01.08.2019
Revision	01

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Issued By:
HSE DEPARTMENT

QATAR STEEL COMPANY (QPSC)

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Revision History

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1.0 Internal Controls

1.1. Review of Procedure

To assure Managements, Shareholders and External agencies confidence in the company's policies & practices, QATAR STEEL Internal Audit may verify compliance with this procedure. [Department Owner] shall review this procedure every three years to ensure that it continues to serve the purpose intended.

1.2. Employee Responsibilities

All employees of the company are required to observe and abide with this procedure.

1.3. Approval

This procedure and any amendments made thereto; require the following approvals.

AUTHORITY



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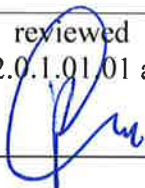
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This document has been reviewed by Document Controller. It complies with the requirements of policy 1.12.0.1.01.01 and it is considered ready for issue.

Signed by



Date

15 JUL 2019

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2.0 Purpose

Qatar's summer climate is very hot and humid with summer temperatures ranging from 33°C to 50°C with relative humidity up to 100%. This climate creates a potentially dangerous situation for those exposed to the heat. Jobs involving operations in hot environment where high air temperatures, radiant heat sources, high humidity, or strenuous physical activities have a high potential to induce heat related illness and injuries to employees engaged in such operations.

The aim of this guideline is to protect the health of the worker from heat related illness and injuries resulting from exposure to heat. This is based on the normal risk based approach.

- The hazard must be identified (Recognition).
- It must be measured (Evaluation).
- The hazard must be reduced or mitigated (Control).

The supervisor or foreman is critical in controlling heat stress among the workers who are potentially exposed to conditions that can promote heat related illness. The supervisor can implement controls when heat stress conditions are identified which will protect the workers, if properly assigned and carried out.

The workers must be trained to recognize the heat stress signs, symptoms and environmental conditions to be ready to protect themselves and those around them. These guidelines identifies fundamental practices and methods of identification of factors that could lead to heat stress and the associated illnesses and provides work practices and other controls that can mitigate or reduce the hazards.

3.0 Scope

This Heat Stress Prevention guideline addresses heat stress identification, evaluation and controls to be implemented to reduce effects of heat related illness & injures such as heat stroke, heat exhaustion, heat cramp, heat rashes, heat fatigue and dehydration among the workers. This guideline is applicable to all personnel in Qatar Steel (including QS employees, contractors and visitors) at all work sites and projects that require individuals to work in a hot climate.

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4.0 Procedure

4.1 Abbreviations & Definitions

HSE - Health Safety & Environment Department

PPE - Personal Protective Equipments

HI - Heat Index

RH- Relative Humidity

Acclimatization - This is a gradual physiological adjustment process that the body makes to improve an individual's ability to tolerate heat. Acclimatization usually takes several days with gradual build up to expected heat loads, workloads and duration of the job.

Buddy system - Pairing of co-workers or team members for the purpose of health protection and looking out for one another.

Heat Index - An index that combines air temperature and relative humidity in an attempt to determine the human-perceived equivalent temperature

Heat Related Illness - Any of the following terms: Heat Stress, Heat Exhaustion, Heat Stroke, brought on by excessive exposure to heat without adequate water, shelter and proper acclimatization.

Dry Bulb Temp. or Air Temp. (DB) - The dry bulb or air thermometer measures the ambient air temperature. This measurement is used in the heat index calculation. A series of white plates surround the sensor to shield it from radiant heat.

Area in charge - The Area in Charge is a person authorized by Manager who will be responsible for keeping his area and staff safe (for all three shifts). Their responsibility includes Management of people, Processes, Materials, Equipment, Infrastructure, Contractors, Sub Contractors, Visitors & Environment.

Relative Humidity (RH) - Relative humidity is the ratio of the quantity of water vapour present in the air to the quantity that would saturate it at any specific temperature.

4.2 Heat Stress & Heat Index

Heat stress occurs when heat is absorbed from the environment faster than the body can get rid of it. The resulting strain on the body comes from the combined contributions of the job (e.g. work activity), environmental factors (e.g. air temperature, humidity, air movement, radiant heat), and worker factors (e.g. extent of acclimatization and hydration).

Heat Stress

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The "Heat Index" has been selected to define general overall heat stress conditions for the workforce. The heat index, also known as "effective temperature", is useful as a first order indicator of the effect of humidity on how hot a particular exposure feels to an individual. It includes no evaluation of the effect of either convective or radiative heat exchange, and does not consider the rates of heat gained by physical activity. The heat index does not take into account air velocity which is a major factor in removing heat and water vapor by convection from the skin and clothing surfaces. The heat index combines relative humidity and air temperature. It is predictive of heat stress in circumstances in which the relationship has been established for a particular environment.

The heat index indicates thermal comfort. When the relative humidity is elevated the evaporative process is restricted which reduces the cooling effect of perspiration. The heat index does not take into account the radiant heat load which is primarily attributed by working in direct sunlight. It also does not take into account the nature of the work (heavy manual work or light work) nor the clothing worn by the worker.

The heat index can be obtained by directly measuring the dry bulb temperature and relative humidity and reading the corresponding heat index from the heat stress table. Refer to Heat Index Chart (Attachment 1).

When the heat index reaches levels that have been known to produce heat illness, additional work practices to reduce the heat stress should be implemented to reduce the effects of the radiant heat load, physical activity, and insulative effect of the clothing and personal protective equipment. Refer to the work practices in the "Control" section.

Instrumentation to determine the heat index must be utilized to measure the air temperature in full shade conditions and measure or calculate the relative humidity. The heat index will be determined using properly calibrated instruments and in accordance with manufacturer's recommendations.

4.2.1 Heat Disorders & Health Effects

Heat Fatigue - A factor that predisposes an individual to heat fatigue is lack of acclimatization. The signs and symptoms of heat fatigue include impaired performance of skilled mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

Heat Rashes - The most common problem in hot work environment, prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by un-evaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to cool environment.

Heat Cramps - These are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating and lack of water replenishment. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Heat Collapse - In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

Heat Exhaustion - Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency. Signs and symptoms: headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat Stroke - Heat stroke is a form of hyperthermia, an abnormally elevated body temperature with accompanying physical and neurological symptoms. This occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. Primary signs and symptoms of heat stroke: confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature (106°F).

4.2.2 Factors contributing to Heat Stress

Heat stress is normally brought about by a range or combination of factors involving the interaction of the Activity/task, environment and the employee.

4.2.2.1 Activity / task Factors

- Frequency of exposure
- Duration of exposure
- Physicality of work
- Inadequate rest periods

4.2.2.2 Environmental Factors

- High air temperatures
- Low air movement
- High relative humidity
- Radiant heat from hot objects such as furnace

4.2.2.3 Employee Factors

- Incomplete acclimatization
- Dehydration
- Excessive or inappropriate clothing
- Medical Condition
- Individual Susceptibility (age, overweight, poor physical condition)

4.3 Heat Stress Control

Controls can be applied to the work situation which could be defined as work practices, personal, administrative, or engineering. Apply them to fit the nature of the task depending on the specific situation.

4.3.1 Engineering Controls

- Feasible engineering controls will be sought and implemented, where practicable to do so, to reduce the heat load on an individual. This may include the following:

4.3.1.1 Shade and Shielding

- Shade is one of the most important heat stress controls for this climate. Radiant heat load can be reduced as much as 10°C degrees when working in shade vs the direct sunlight. (Wind screens provide some measure of shade yet allow significant radiant heat through and reduce ventilation.)
- Radiant heat sources such as hot pipes in regular work areas should be insulated to reduce heat load. Re-insulation, either temporary- or permanent should be done as soon as possible after repairs.
- For non-routine work areas without insulation on hot sources temporary-insulating blankets should be used to shield the sources while work is being done in the area.
- As a minimum guideline, the shaded area must have green net on all the sides including the top to prevent direct sun light with seating arrangements to rest. Cool drinking water is to be provided with glasses/flasks to drink. Necessary drainage arrangements are to be made to drain the excess water. Using hands as a means to drink water is to be avoided. Food may only be consumed in the designated dining facilities.

4.3.1.2 Area Cooling

- Spot cooling equipment such as misting fans can be utilized when the work is in one fixed location such as a valve or control box. The cool air flow streams need to be

directed towards the workers and the discharge ducts should be as close as practical to the work area.

- Portable trailer mounted air conditioning units can be utilized for larger enclosed areas such as confined spaces or vessels. These units can help to significantly reduce heat stress and greatly increase the job efficiency.
- Shaded break areas should be kept cooler than the work areas to facilitate quicker recovery from the effects of heat. It is recommended that a 10-15 degree difference in temperatures to be maintained between work area and break area. This will avoid excessive cooling which is not recommended except for heat emergencies. Where cooling of a break area is not feasible, air circulation with fans should be used to help with cooling through sweat evaporation.

4.3.1.3 Ventilation

- Increasing airflow through a work area, such as fans and air conditioning, will help increase the evaporation rate and cooling of the people. This will not be effective if the temperature of the air blowing across the workers is over 40 °C since it may then actually result in increased heat stress.
- Confined spaces should be evaluated for proper ventilation. If needed, cool air should be pulled in near the workers. This may require relocation of the air movers and the opening / closing of man ways as the work progresses to assure proper air distribution.

4.3.1.4 Mechanical Aid

- Where practical, mechanical assistance should be used to reduce the physical requirements of the job and thus reduce the metabolic rate. For example use an appropriate lifting equipment / transportation to move material rather than making several trips using heavy loads. Use a backhoe for digging or spreading of gravel rather than manual handwork digging.

4.3.2 Administrative Controls & Work Practices

4.3.2.1 Acclimatization

- The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.
- A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods.

4.3.2.2 Work Scheduling

- Scheduling extremely hot jobs for the cooler part of the day, at night or for a cooler day if possible.
- Where possible, postpone the hot job until equipment can be taken out of service and allowed to cool down.
- Schedule additional time for hot jobs to allow for additional cooling breaks especially if cooling measures are not used.

4.3.2.3 Work Rest Intervals

- On hot days or for hot jobs, more frequent breaks should be planned especially if heavy work is involved.
- Rest breaks should be taken in a cool location and cool fluids consumed. Avoid hot beverages and those that contain caffeine such as tea, coffee and sodas.

4.3.2.4 Self Evaluation

- Each person while working in hot conditions (high temperatures) must be aware of the signs and symptoms of heat stress related illnesses and early warning indications, so they can recognize them in themselves or their colleagues. Typical symptoms include weak and fatigue, painful muscle cramps, headache and dizzie, nauseated, heavy sweating.
- The supervisor should be notified of any early indications and corrective action taken.
- Heart rate (rapid pulse) is one of good indicators of the degree of heat stress that a person is experiencing.
- Most individuals can be trained to monitor their own heart rate. On jobs where heat stress is a concern periodically pause work and immediately take a pulse for 15 seconds. Multiply this by 4 to get the heart rate.
- Healthy acclimatized workers should avoid prolonged work or environmental combinations that cause their heart rate to exceed the recommended maximum heart rate, maximum heart rate when taken during the first minute of rest. The heart rate should drop to 110 – 120 beats per minute following the first minute of rest. Maximum heart rates should be below the following levels.

Age	Max. Rate
20	162
30	157
40	152
50	147
60	141

- Urine color to be checked by individual to identify the level of dehydration as per the Attachment 3 - Urine Chart

Since each person is different and medical conditions can affect reaction to heat stress, it is important to remember that these are only average indicators. The individual's maximum recommended rate could be lower. Workers must remain alert to other signs of excessive heat stress.

4.3.2.5 Employee Rotation

- Physical activities exposed to hot environment must follow the frequent rotation as per the attachment 2 (Guide on Work Practices to Minimize the Effect of Heat Exposure). Workers in additional clothing or suits (e.g. Aluminum Jacket) must be rotated more frequently. If in chemical protective suits or proximity suits, additional cooling devices must be used or workers must be rotated per the attachment 2 (Guide on Work Practices to Minimize the Effect of Heat Exposure).
- The split job tasks or rotation between workers will relieve a lot stress besides giving them an opportunity to take rest pauses.

4.3.2.6 Fluid Replacement

- One of the most important means of reducing the risk of heat stress is drinking plenty of fluids (cold water). When doing hard work in hot areas dehydration may occur due to heavy sweating before a person even feels thirsty. It is recommended that at least 250 ml of fluids be consumed every 20 minutes to prevent dehydration and reduce the risk of illness. Refer to Guide on Work Practices to Minimize the Effect of Heat Exposure (attachment 2).
- Cool water should be readily available during warm weather or in hot work areas.
- Salt supplements are not recommended and must be taken upon advice of a doctor. A well balanced diet should replace all necessary salts and electrolytes.

4.3.2.7 Buddy System

- When working in hot environment, consideration should be given to working in pairs with each person watching out for early warning signs of heat stress in the other person.
- In high temperature confined spaces, the person on watch should be alert to the warning signs of heat stress and should ensure that any conditions of entry such as frequent rest breaks and job rotation are followed.

4.3.2.8 Monitoring

- The below parameters must be monitor to identify the level of Heat Stress.
 - a. Temperature
 - b. Humidity
 - c. Heat Index
 - d. Wind Speed
- Period of monitoring shall be performed during the summer season.

4.3.2.9 Flagging System

- Use of colour coded flagging system in accordance with the Heat Stress Index is strongly recommended at all open work place area to ensure that the Heat Stress Management system is consistently applied throughout the outdoor work sites.

4.3.2.10 Communication

- If the Heat Index reached to the 39 (Amber) or above the information shall be communicated via Public Address system / mail / sms to employees.

4.3.2.11 Training

- Employees and contractors must be trained to recognize symptoms of heat stress prior to performing work in potentially heat stress environment.
- Training must include recognition of signs and symptoms of heat stress in themselves and co-workers, work rest schedule, emphasis on fluid intake.
- Training should be conducted closer to the summer months to ensure awareness among workers. This can take place at “toolbox” talks and or JSA discussion sessions at the beginning of each shift.
- Display heat stress awareness posters/ charts.

4.3.3 Personal Protective Equipment

- Three variables associated with clothing alter thermal balance: insulation, permeability and ventilation. Cotton clothing provides most of these variables. Clothes should be made of thin cotton (eases evaporation) loose fitting, light in weight and color (reflects heat). Clothes should be regularly washed to remove the sweat and salt which can irritate the skin and lead to infection. Long sleeved shirts and trousers are recommended. A hardhat should be worn to protect the head face and neck. Tinted safety glasses can reduce damage to the eyes.
- In certain situations personal protective equipment (eg: face masks, impermeable fire protective clothing) must be worn which can aggravate heat stress by not allowing sweat to evaporate. Special working practices may need to be adopted. There are synthetic under garments made up of combed cotton and polyolefin fibres which wick moisture away from the skin leaving the body dry.
- Cooling devices (e.g. ice vests water circulating cool suits, air circulating, and reflective clothing) may need to be worn for very specific tasks. However because they represent a potential safety hazard a work assessment should be performed prior to their employment.

4.4 Roles & Responsibilities

4.4.1 Area In charge

All Area In charge are required to ensure that these guidelines are taken up on their respective Heat Stress Management System and that it is followed without exception for employees and contractors. All Heat Stress or Heat Stress related incidents must be reported to HSE Department immediately.

- Review heat stress precautions in respect of work to be performed in hot locations.
- Consider scheduling the hottest jobs for the cooler part of the day or nights, or the use of other methods to reduce heat stress.
- Scheduling, plan for additional breaks, as needed, to cool off on hot jobs in particular hot conditions.
- Evaluate non-routine jobs where there may be a heat stress concern.
- Stop work as and when required in terms at Heat Index indicator.

4.4.2 Medical Officer

- Make sure that all Heat Stress related incidents reported are properly investigated and recorded.
- Report immediately any Heat Stress incident to HSE Department.

4.4.3 Employees

- Be familiar with the early warning signs of heat stress in themselves and co-workers and take immediate action when they are noted.
- Utilize personal protective equipment as needed.
- Drink plenty of fluids prior to entering a hot environment and continuously when indicated to prevent dehydration.
- Take regular rest breaks.
- Inform the supervisor of any heat stress concerns relating to the work place.

4.4.4 Supervisors

- Implement heat stress controls in accordance with the heat index.
- Monitor subordinates exposure to heat and modify work schedules accordingly.
- Apply effective controls to control the heat at work.
- Schedule the most physical activities, if possible for the coolest part of the day.
- Provide cool water and encourage employees to drink fluids regularly. As the intensity of work activity and heat index climbs, increase more fluids.
- Adopt the buddy system which encourages fellow employees to look out for each other.
- Ensure employees are aware of the symptoms of Heat stress. Employee training should also be focused on protective measures for working in high heat and humidity in work place areas.

4.5 Implementation and Auditing

- Implementation of the guideline is the responsibility of all the departments.
- Auditing of this guideline will be conducted by the HSE Department. Audit frequency to be performed monthly during the summer season.

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4.6 Breach of this procedure

- Any breach of this procedure will be treated as a life saving rule violation and will be dealt with through the Qatar Steel disciplinary procedure.

4.7 Attachments

Attachment 1- Heat Index Chart

GENERAL HEAT STRESS INDEX										
DANGER CATEGORY		HEAT INDEX			HEAT SYNDROME					
IV. Extreme Danger		> 54			Heat Stroke or Sunstroke imminent					
III. Danger		39 - 53			Sunstroke, Heat Cramps or Heat Exhaustion likely, Heat Stroke possible with prolonged exposure and physical activity					
II. Extreme Caution		32 - 38			Sunstroke, Heat Cramps or Heat Exhaustion possible, Heat Stroke possible with prolonged exposure and physical activity					
I. Caution		27 - 31			Fatigue possible with prolonged exposure and physical activity					
* Note: Degree of Heat Stress may vary with age, health and body characteristics.										
		RELATIVE HUMIDITY (Rh)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
AIR TEMPERATURE (°C)	50	44	52	54	>54	>54	>54	>54	>54	>54
	49	43	51	54	>54	>54	>54	>54	>54	>54
	48	43	50	53	54	>54	>54	>54	>54	>54
	47	42	48	52	54	>54	>54	>54	>54	>54
	46	41	47	50	54	>54	>54	>54	>54	>54
	45	41	46	50	54	>54	>54	>54	>54	>54
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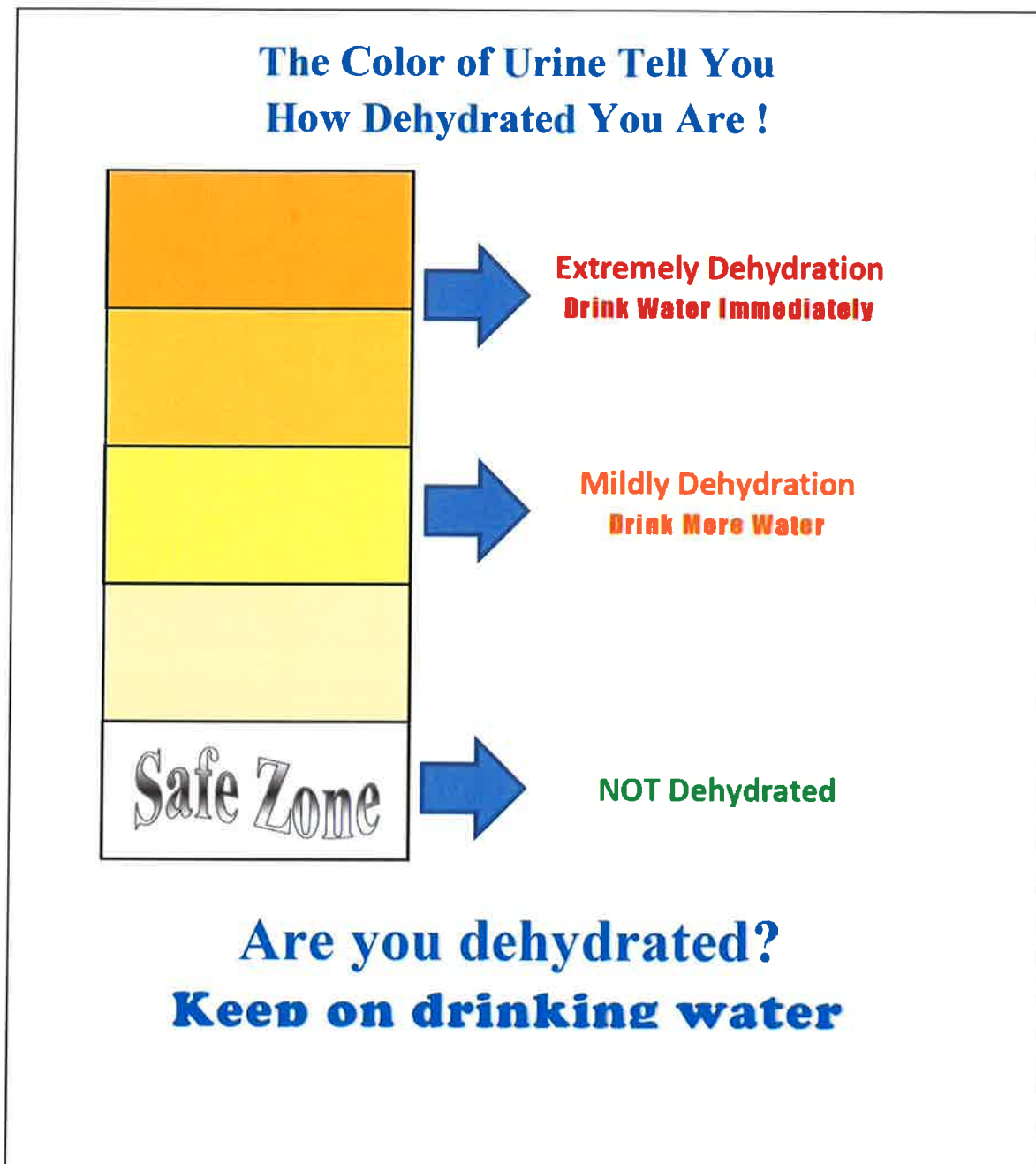
Attachment 2 - General Heat Stress Index

GENERAL HEAT STRESS INDEX		
SEVERITY	HEAT INDEX	HEAT SYNDROME
1. Caution	27 - 31	Fatigue, Heat Cramps or Heat Exhaustion possible with prolonged exposure and heavy physical activities.
2. Extreme Caution	32 - 38	Heat Cramps or Heat Exhaustion possible with prolonged exposure and physical activities.
3. Danger	39 - 53	Heat Cramps or Heat Exhaustion likely, Heat Stroke possible with prolonged exposure and physical activities.
4. Extreme Danger	> 54	Heat Stroke or Sunstroke imminent.

Attachment 3 – Guideline on Work Practices to Minimize the Effect of Heat Exposure

PREVENTATIVE HEAT STRESS WORK PRACTICES TO MINIMIZE THE EFFECT OF HEAT EXPOSURE			
HEAT INDEX	WORK : REST PERIOD (MINUTES)	WATER REQUIREMENTS (1 CUP = 1/4 LITRE)	CONTROLS
27 – 31	50 : 10	Minimum 01 Cup Every 20 minutes	Continual Visual Monitoring of Workers in Direct Sun and Heavy Work
32 – 38	40 : 10	Minimum 01 Cup Every 20 minutes	No working alone. Take breaks as needed
39 – 49	30 : 10	Minimum 01 Cup Every 15 minutes	Work under shade. Take frequent breaks. Possibly reschedule heavy work tasks
50 – 53	20 : 10	Minimum 01 Cup Every 10 minutes	Stop elevated and Confined Space work activities
>54	---	---	Stop all work activities
Note: <ol style="list-style-type: none"> 1. Degree of Heat Stress may vary with age, health and body characteristics. 2. Do not take any form of "Salt Supplement" unless advised by a doctor. 3. "Emergency Work" – When the index reaches >54, the Production Departments need to consult with the HSE Department to determine what mitigation will be applied to minimize the risk of heat stress. 			

Attachment 4 – Urine chart



Attachment 5 – Heat Stress Symptoms and First Aid

Condition	Symptoms	First Aid
Heat Rash	<ul style="list-style-type: none"> - Red, itchy skin 	<ul style="list-style-type: none"> - Keep skin clean and dry - Avoid scratching
Heat Fatigue	<ul style="list-style-type: none"> - Lack of coordination - Decreased mental ability (thinking, memory, concentration) - Tiredness / fatigue 	<ul style="list-style-type: none"> - Remove individual from heat source - Move to cool / shaded area
Heat Collapse	<ul style="list-style-type: none"> - Temporary loss of consciousness 	<ul style="list-style-type: none"> - Remove individual from heat source - Move to a cool / shaded area
Heat Cramps	<ul style="list-style-type: none"> - Painful muscle spasms in arms, legs and abdomen - Profuse sweating 	<ul style="list-style-type: none"> - Move to cool location - Give water to drink - massage cramping muscles
Heat Exhaustion	<ul style="list-style-type: none"> - Headache - Nausea - Vertigo / dizziness - Weakness - Thirst - Cold, clammy, skin with excess sweat 	<ul style="list-style-type: none"> - Move to cool location - Open clothing - Give water to drink if conscious - Victim must lie flat except when drinking
Heat Stroke (Medical Emergency)	<ul style="list-style-type: none"> - Erratic Behavior - Skin is hot, dry, flushed, not sweating - Weakness, Unsteady Gait - Body Temperature elevated - Convulsions - Loss of Consciousness - Can lead to death if untreated 	<ul style="list-style-type: none"> - Remove excess clothing from the victim - Douse victim with cool water until medical help arrives - Place a covered ice bag on victims head if available

Appendix 1 – Heat Stress Audit Protocol – COR/HSE/SE/F054-01